Multiple knowledge representation for big data artificial intelligence: framework, applications, and case studies

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Abstract

In this paper, we present a multiple knowledge representation (MKR) framework and discuss its potential for developing big data artificial intelligence (AI) techniques with possible broader impacts across different AI areas. Typically, canonical knowledge representations and modern representations each emphasize a particular aspect of transforming inputs into symbolic encoding or vectors. For example, knowledge graphs focus on depicting semantic connections among concepts, whereas deep neural networks (DNNs) are more of a tool to perceive raw signal inputs. MKR is an advanced AI representation framework for more complete intelligent functions, such as raw signal perception, feature extraction and vectorization, knowledge symbolization, and logical reasoning. MKR has two benefits: (1) it makes the current AI techniques (dominated by deep learning) more explainable and generalizable, and (2) it expands current AI techniques by integrating MKR to facilitate the mutual benefits of the complementary capacity of each representation, e.g., raw signal perception and symbolic encoding. We expect that MKR research and its applications will drive the evolution of AI 2.0 and beyond.